Appendix E: Circuit Diagrams

1 Photodiode Detector

Photodiodes are used to measure the intensity of the DFB lasers. The circuit converts the current signal from the InGaAs detectors to a voltage signal and provides adjustable amplification. Capacitors between the ground and power sources (not shown) filtered out line noise. The circuit was designed to have a bandwidth of 10kHz. The circuit diagram is shown in Figure E.1. The frequency response of the circuit, measured by chopping the optical input, is shown in Figure E.2.

Figure E.1. Photodiode Circuit. The circuit amplifies and filters the photodiode signal.
Photodiode Circuit

0 100 200 300 400 500 600 700 800 900 1000

Mag dB

f, Hz

Photodiode Circuit Frequency Response. The magnitude and phase are relatively constant from 0-955 Hz.

2 Photomultiplier Tube

A photomultiplier tube (PMT) is used to convert light flux to an electric current for the OH* chemiluminescence measurement. The circuit converts the current signal to a voltage and provides amplification. The circuit used for the laminar burner allows for adjustment of the DC voltage, as seen in Figure E.3. The circuit used for the turbulent combustor was very similar to the photodiode circuit, with different resistance values. The frequency response for the circuit is shown in Figure E.4.
Figure E.3. PMT Circuit. The circuit provides signal conditioning for the photomultiplier tube.
Figure E.4. PMT Circuit Frequency Response. The phase varies 15 degrees over 3 kHz.

3 Dynamic Velocity Probe

The two-microphone technique was used to measure time-varying flow velocity. For an in-depth discussion of this technique, see [1]. The circuit diagram is shown in Figure E.5. The frequency response is shown in Figure E.6.
Figure E.5. Dynamic Velocity Probe Circuit. The circuit simulates the 1-D Euler equation to measure velocity from two microphones.
Figure E.6. Dynamic Velocity Probe Circuit FRF. (a) laminar burner (b) turbulent combustor.

Bibliography